

CHAPTER-4 Absorption by Roots - the processes involved.

This lesson is for Class 9 for the subject of Biology. Topic - Characteristics of roots for absorbing water, Imbibition and Diffusion which is covered in Chapter 4 Absorption by Roots - the processes involved starting on Page No 37 of your text book - Concise Biology - Selina Publications and is being submitted to you on 30 09 24

Dear students before starting with how the water is absorbed by the plants roots let us first understand why the water is absorbed by roots, that is -

NEED OF WATER AND MINERALS FOR PLANTS -

- i) Photosynthesis - Water is one of the raw materials for the process of photosynthesis.
- ii) Transpiration - is the process of loss of water from the aerial parts of the plant. Transpiration brings about cooling effect to the plant. The loss of water is only possible if water is absorbed by the plant.
- iii) Translocation - minerals are transported from roots to various parts of the plant in solution form. Similarly food synthesised in leaves is transported to various parts of plant in solution form. Thus water is required as solvent in the solution.
- iv) Mechanical stiffness - Cells by absorbing water become stretched and fully distended thus giving stiffness or turgidity to soft parts of plant.

Minerals are also absorbed by plant roots which are required for synthesis of variety of compounds or enzymes within the cell.

Minerals are also present as constituents of cell and cell organelles.

CHARACTERISTICS OF ROOTS FOR ABSORBING WATER

(1) Plant roots have enormous surface area. Each rootlet has hundreds of small root hairs. Children look at Fig 4.2 in your book showing the structure of root hair. All students are required to practice the diagram of root hair in your notebooks. Root hairs are extension of ^{epidermal} cells.

2) Root hairs contain cell sap of higher concentration. Cell sap [i.e. the solution present in the vacuoles] contains dissolved salts making the cell sap concentration higher than the water surrounding the root hair cells. This causes osmosis i.e. movement of water from its higher concentration [i.e. from surrounding areas] to inside the root hair cells [where the concentration of water is less].

Details of osmosis we will be doing later in the chapter.

3) Root hairs have thin walls; both cell wall and cell membrane is thin. Cell membrane being selectively permeable allows only water molecules to pass through, and not the large molecules of the dissolved salts.

Above listed 3 characteristics of roots help plant to absorb water. Various processes/phenomena are involved in absorbing the water by the roots which we will be discussing in the chapter. But before going further let us take a short break. Answer the following questions during the break.

Q.1 Root hairs are extension of — cells

Q2. Cell sap of root hairs have _____ concentration than the water surrounding the root cells.

Q3. Root hairs have _____ walls to facilitate the inward movement of water and minerals in the roots.

Children You may pause the lesson for 5 mins break and fill in the blanks as given to you.

Break is over children. Listen to the correct answers -

Ans 1. Epidermal cells i.e. cells of epidermis.

Ans 2. higher concentration

Ans 3. thin walls.

Now let us resume the topic with discussion of the processes involved in absorption of water by the roots.

[1] IMBIBITION is a phenomenon in which living or dead plant cells absorb water by surface attraction. In imbibing system water always moves with some force from a more saturated region to a relatively less saturated region. It is the passive absorption of water by substances such as cellulose and starch and proteins.

The seeds and grains swell up due to imbibition and endosmosis when soaked in water. The force thus generated by absorbed water is strong enough to crack the seed coats. Thus dry seeds, wooden doors swell up on contact with water or on exposure to moist air. Imbibition pressure helps in ascent of sap by the root hair i.e. upward movement of water and dissolved salts.

Note - The attraction of dry cell wall and protoplasm for water causes an imbibition pressure to develop within the seeds, and in turn burst seed coat.

DIFFUSION - Diffusion is basically mixing of molecules. Diffusion is free movement of molecules of a substance (solute or solvent, gas, liquid) from the region of their higher concentration to the region of their lower concentration when the two are in direct contact.

Example of diffusion - Light an incense stick in a room. Wait for 5-10 min. and then visit the room again. You will smell the fragrance of incense stick in every corner of the room. Children kindly look at Fig 4.3 on Page No 39 of your text book i.e. Diffusion of a soluble dye in water forming a solution and understand the experiment 1 as discussed below -

AIM - To demonstrate diffusion.

If you drop a crystal of potassium permanganate (chosen for its visibility) in still water, it dissolves and the molecules of this substance diffuse until evenly spread. This takes several hours (depending on temperature) but can be speeded up by stirring and you get a homogenous solution much faster. Based on the experiment 1 students are

required to answer the following questions

Q1 What is the aim of the experiment?

Q2 Name the process depicted in the experiment and define it.

Q3 What is the result of the experiment?

[Answers will be provided to you]

Now let us discuss the third process that helps in ascent of sap in plant i.e.

OSMOSIS - is diffusion of water molecules only.

It is defined as net movement of water molecules from a region of their higher concentration (i.e. dilute solution or with lower solute concentration) to their region of lower concentration (i.e. concentrated solution or with a higher solute concentration) through a partially permeable membrane.

With reference to a cell the osmosis can be either inward or outward depending on the extent of concentration of solutions surrounding it.

ENDOSMOSIS is the inward movement of water through a semi permeable membrane when the solution surround the cell is of lower concentration. This tends to swell up the cell.

EXOSMOSIS is outward movement of water through a semi permeable membrane when the solution surrounding the cell is of higher concentration. This tends to shrink the cell.

If concentration of both the solutions on either side of semi permeable membrane is same, there will be no net movement of molecules in either of the directions.

With this I am ending today's discussion.

Kindly go through the given explanation and answer the following home assignment questions in the notebooks.

HOME ASSIGNMENT -

Q1 Draw a well labelled diagram of Root hair

Q2 Define -

a) Imbibition

b) Diffusion

c) Osmosis.